

# BIG PRAIRIE

## FLATHEAD COUNTY

---

The Big Prairie air monitoring site was established by the Montana Air Quality Bureau as part of the Flathead River Basin Environmental Impact Study. The site is located near Polebridge at 48 48 29 N and 114 18 41 W (Site No. 41 on Map II-1 in the valley of the North Fork of the Flathead River. Elevation at the site is 3,587 feet. The valley in this area is about 5 miles wide and is bordered by mountain ranges rising 8,000 and 10,000 feet above sea level. The valley site, therefore, is representative only of a relatively small area.

Data collection began on November 7, 1978, and data through January 4, 1982, were available for analysis. Data recovery, however, was poor, ranging from 0.0 percent in February to 93.0 percent in July. Overall data recovery during the monitoring period was 42.8 percent. The site is located 2 miles from the nearest road, and because of heavy snow and severe cold, it frequently is inaccessible during the winter. Consequently, major breaks exist in the data set. No data are available for the periods December 25, 1978, through June 7, 1979, and November 8, 1979, through March 31, 1980. Winds were monitored long enough, however, to adequately represent the wind resource at this location during the summer months.

The data set contains hourly averages of wind speed and wind direction manually reduced from stripchart records. The data were collected by a battery-operated Climatronics electronic anemometer and wind vane on a 10-meter tower.

Average monthly wind speeds were low at this site; they ranged from 2.4 miles per hour in January to 4.8 miles per hour in April. Average annual wind speed was 3.4 miles per hour. Average wind speeds were highest from April through July.

Average annual wind power at the site was 8.4 watts/m<sup>2</sup>. Monthly averages varied from 4.2 watts/m<sup>2</sup> in January to 18.0 watts/m<sup>2</sup> in April.

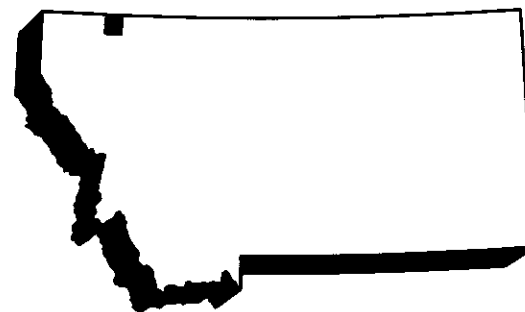


Table IV - 60  
 Monthly Wind Speed Distribution  
**FLATHEAD COUNTY - BIG PRAIRIE**  
 11/07/78 - 01/04/82

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR		
	CALM	8.1	0.0	7.7	13.8	15.3	13.4	13.5	20.6	29.0	30.2	15.2	7.5	17.0	CALM	
S P E E D	0.1-1.0	12.8	0.0	5.1	3.2	1.6	1.2	2.6	3.8	2.7	5.4	4.4	15.8	4.2	0.1-	0.4
	1.1-2.0	37.2	0.0	23.8	11.6	12.0	12.7	13.8	13.3	12.4	17.0	20.4	31.4	16.2	0.5-	0.9
	2.1-3.0	12.8	0.0	12.6	11.4	15.6	14.5	13.6	15.0	13.9	14.6	22.8	15.3	15.4	1.0-	1.3
	3.1-4.0	7.0	0.0	9.8	8.6	9.8	12.1	9.6	10.5	8.2	5.7	10.9	8.1	9.6	1.4-	1.8
	4.1-5.0	5.8	0.0	9.1	5.0	10.1	8.7	7.9	9.0	6.8	5.0	6.1	6.0	7.5	1.9-	2.2
M I L E S / H O U R	5.1-6.0	1.2	0.0	7.7	5.1	7.0	6.9	8.8	7.8	5.8	6.0	5.6	3.7	6.6	2.3-	2.7
	6.1-7.0	5.8	0.0	5.1	6.0	6.2	5.9	6.6	6.0	6.1	4.8	6.0	3.3	5.8	2.8-	3.1
	7.1-8.0	3.5	0.0	7.9	9.0	7.0	7.8	7.6	4.9	5.2	5.4	3.7	4.0	6.0	3.2-	3.6
	8.1-9.0	3.5	0.0	5.1	7.6	4.2	6.4	7.2	4.2	4.4	2.2	1.7	2.1	4.6	3.7-	4.0
	9.1-10.0	1.2	0.0	2.8	5.3	3.3	3.5	3.7	2.4	2.2	1.5	1.3	0.7	2.6	4.1-	4.5
	10.1-11.0	1.2	0.0	0.9	5.5	3.1	3.5	2.9	1.3	1.3	0.6	0.6	1.0	2.0	4.6-	4.9
	11.1-12.0	0.0	0.0	0.7	3.5	1.5	1.9	1.2	0.6	0.9	1.2	0.6	0.5	1.1	5.0-	5.4
	12.1-13.0	0.0	0.0	1.6	2.7	1.9	1.1	0.5	0.4	0.4	0.4	0.1	0.0	0.7	5.5-	5.8
	13.1-14.0	0.0	0.0	0.0	1.0	0.8	0.4	0.3	0.2	0.3	0.0	0.3	0.3	0.4	5.9-	6.3
	14.1-15.0	0.0	0.0	0.0	0.5	0.7	0.0	0.1	0.1	0.1	0.0	0.1	0.3	0.2	6.4-	6.7
	15.1-16.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	6.8-	7.2
	16.1-17.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	7.3-	7.6
	17.1-18.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.7-	8.0
	18.1-19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.1-	8.5
	19.1-20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.6-	8.9
	20.1-25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0-	11.2
	25.1-30.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.3-	13.4
	30.1-35.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.5-	15.6
	35.1-40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.7-	17.9
	>40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	>17.9	
AVERAGE SPEED (MPH)		2.4	ND	3.7	4.8	4.1	4.1	4.0	3.2	3.0	2.5	2.8	2.5	3.4		
AVERAGE SPEED (M/SEC)		1.1	ND	1.6	2.2	1.8	1.8	1.8	1.4	1.3	1.1	1.2	1.1	1.5		
AVERAGE WIND POWER (WATTS/M**2)		4.2	ND	8.8	18.0	12.0	10.9	9.6	6.4	7.1	5.2	5.0	4.7	8.4		
PERCENT DATA RECOVERY		3.7	0.0	19.2	27.9	38.5	65.5	93.0	75.4	67.5	30.6	57.8	32.8	42.8		

ANEMOMETER HEIGHT = 10 METERS = 33 FEET  
 NUMBER OF OBSERVATIONS = 11850  
 PERCENTAGE DATA RECOVERY = 42.8

SOURCE: GEORESEARCH, INC.

# COLUMBIA FALLS WATER SUPPLY

## FLATHEAD COUNTY

---

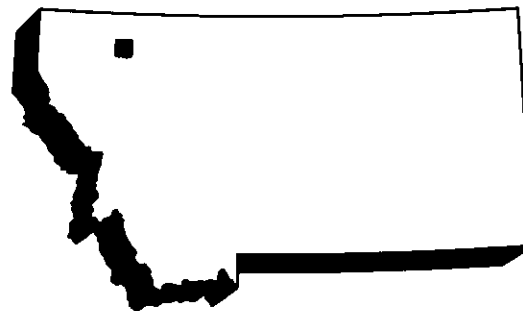
The Columbia Falls Water Supply air monitoring site is located about 1 mile northeast of Columbia Falls at 48 24 05 N and 114 08 32 W (Site No. 46 on Map II-1). Elevation at the site is 3,129 feet. The site was established by the Montana Air Quality Bureau to measure particulate concentrations in the area and to provide data for the Flathead River Basin Environmental Impact Study.

Wind data collected from February 16, 1977, through October 22, 1979, were available for analysis. The data set contains hourly averages for wind speed and direction manually reduced from stripchart records. The data were gathered by a Climatronics electronic anemometer and wind vane on a 10-meter tower.

Winds have been monitored long enough to adequately represent the wind resource at this location. The site is representative only of the immediate area, however, because it is located at the base of Teakettle Mountain and near the mouth of a large canyon. Data recovery, which for the period was 83.7 percent, ranged from 66.9 percent in August to 96.9 percent in October.

Average monthly wind speeds varied from 5.0 miles per hour in September to 7.7 miles per hour in August. Average annual wind speed was 6.4 miles per hour.

Average monthly wind power ranged from 15.9 watts/m<sup>2</sup> in September to 100.6 watts/m<sup>2</sup> in February. Average annual wind power was 48.3 watts/m<sup>2</sup>.



**Table IV - 61**  
**Monthly Wind Speed Distribution**  
**FLATHEAD COUNTY - COLUMBIA FALLS WATER SUPPLY**  
**02/16/77 - 10/22/79**

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR	
CALM	0.0	0.2	0.1	0.7	0.5	1.3	0.2	0.3	0.1	0.1	0.0	0.0	0.3	CALM
0.1-1.0	2.0	0.5	0.2	0.0	0.0	1.2	0.1	0.4	0.7	0.2	0.5	0.1	0.5	0.1- 0.4
1.1-2.0	9.4	6.3	2.5	1.1	2.7	4.1	3.2	4.4	5.5	3.3	4.2	3.2	4.0	0.5- 0.9
S 2.1-3.0	17.6	15.8	7.6	5.6	6.6	9.3	8.7	6.2	10.5	9.4	8.5	11.5	9.4	1.0- 1.3
P 3.1-4.0	20.7	17.8	14.2	10.0	11.2	13.7	18.1	10.3	17.7	19.3	14.3	14.7	15.1	1.4- 1.8
E 4.1-5.0	11.4	10.6	13.3	11.4	13.6	16.9	14.2	13.7	19.1	19.6	13.8	11.3	14.4	1.9- 2.2
E 5.1-6.0	8.3	9.9	13.5	14.1	13.4	15.1	13.2	12.9	15.7	17.7	11.8	13.0	13.5	2.3- 2.7
D 6.1-7.0	4.4	6.7	8.4	10.7	10.8	9.3	11.9	8.2	9.9	8.8	8.0	6.5	8.9	2.8- 3.1
7.1-8.0	4.6	5.2	6.7	10.1	10.9	8.6	9.9	8.7	8.5	6.9	7.6	6.4	8.0	3.2- 3.6
M 8.1-9.0	3.1	7.0	5.3	8.9	7.1	6.8	5.6	5.5	5.1	4.5	4.9	4.4	5.8	3.7- 4.0
I 9.1-10.0	1.7	2.6	3.6	5.6	5.6	3.1	2.1	2.9	1.6	2.0	3.1	3.4	3.2	4.1- 4.5
L 10.1-11.0	2.3	3.9	4.8	4.4	6.0	3.4	3.7	4.1	1.7	2.7	4.9	4.7	3.9	4.6- 4.9
E 11.1-12.0	1.5	1.1	2.7	3.0	3.2	1.7	1.4	2.0	0.8	1.0	2.9	3.4	2.0	5.0- 5.4
S 12.1-13.0	1.8	1.2	2.4	3.3	2.9	1.3	1.1	2.1	0.3	1.0	2.9	3.7	1.9	5.5- 5.8
/ 13.1-14.0	1.6	0.7	1.8	1.3	2.3	0.7	1.2	2.5	0.3	0.8	2.0	2.0	1.4	5.9- 6.3
H 14.1-15.0	0.7	0.5	1.3	1.2	0.9	0.4	0.6	1.2	0.7	0.5	0.9	1.5	0.9	6.4- 6.7
O 15.1-16.0	1.1	0.4	2.4	1.3	1.3	0.8	0.9	2.9	0.5	0.6	2.7	1.5	1.3	6.8- 7.2
U 16.1-17.0	0.7	0.2	1.4	1.0	0.4	0.6	0.5	0.8	0.2	0.5	1.4	0.5	0.7	7.3- 7.6
R 17.1-18.0	0.4	0.2	1.1	1.0	0.0	0.4	1.1	1.7	0.3	0.4	1.5	0.2	0.7	7.7- 8.0
18.1-19.0	0.2	0.9	0.5	0.8	0.2	0.6	0.9	2.1	0.1	0.5	0.2	0.8	0.6	8.1- 8.5
19.1-20.0	0.6	0.6	0.5	0.4	0.0	0.1	0.4	0.9	0.2	0.2	0.4	1.1	0.4	8.6- 8.9
20.1-25.0	3.4	4.2	4.1	3.9	0.4	0.8	1.0	5.9	0.8	0.4	1.6	4.7	2.4	9.0-11.2
25.1-30.0	1.4	2.3	1.4	0.3	0.0	0.0	0.1	0.3	0.0	0.0	0.9	1.4	0.6	11.3-13.4
30.1-35.0	1.1	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.2	13.5-15.6
35.1-40.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	15.7-17.9
>40.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	>17.9
AVERAGE														
SPEED (MPH)	6.1	6.8	7.5	7.5	6.4	5.5	5.9	7.7	5.0	5.3	7.1	7.4	6.4	
AVERAGE														
SPEED (M/SEC)	2.7	3.0	3.3	3.3	2.9	2.5	2.6	3.4	2.2	2.3	3.2	3.3	2.9	
AVERAGE														
WIND POWER														
(WATTS/M**2)	81.1	100.6	72.6	56.6	26.7	21.3	27.1	66.8	15.9	17.8	71.8	73.9	48.3	
PERCENT DATA														
RECOVERY	95.3	78.2	87.5	84.0	96.5	73.6	72.5	66.9	93.9	96.9	88.6	72.2	83.7	

ANEMOMETER HEIGHT = 10 METERS = 33 FEET  
NUMBER OF OBSERVATIONS = 19642  
PERCENTAGE DATA RECOVERY = 83.7

SOURCE: GEORESEARCH, INC.

# KALISPELL NWS AIRPORT

## FLATHEAD COUNTY

---

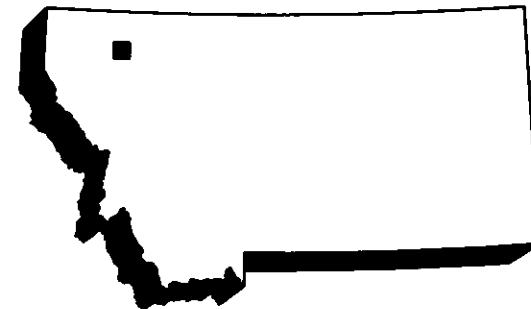
The Kalispell NWS Airport is located approximately 8 miles north-northeast of Kalispell at 48 18 40 N and 114 16 00 W (Site No. 48 on Map II-1). Elevation at the airport is 2,978 feet.

Meteorological data have been collected at this site for many years by the National Weather Service. These data, primarily collected for aviation and weather forecasting uses, consist of short-term (5 minutes or less) averages of wind speed and wind direction, as well as other meteorological parameters. Data were gathered once per hour. The data have been analyzed by Battelle Pacific Northwest Laboratories. Because of changes in anemometer heights and reporting intervals, the data set was broken into four parts for analysis: May 1, 1949, through June 30, 1953; July 1, 1953, through June 30, 1959; July 1, 1959, through June 30, 1964; and July 1, 1964, through December 31, 1978. Only data from the most recent of these periods were selected for inclusion in the *Montana Wind Energy Atlas*.

The data set for the site consists of summaries of observations made every third hour from July 1, 1964, through December 31, 1978. The anemometer was mounted on a ground mast at a height of 6.1 meters. The site is representative only of the immediate area because winds at the site are influenced by Flathead Lake to the south and a canyon to the northeast.

Average monthly wind speeds at Kalispell varied from 5.6 miles per hour in October and November to 8.5 miles per hour in April. Average annual wind speed was 6.9 miles per hour.

Average monthly wind power ranged from 34.0 watts/m<sup>2</sup> in October to 78.0 watts/m<sup>2</sup> in January. Average annual wind power at the site was 53.0 watts/m<sup>2</sup>.



**Table IV - 62**  
**Monthly Wind Speed Distribution**  
**FLATHEAD COUNTY - KALISPELL NWS AIRPORT**  
**07/01/64 - 12/31/78**

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR	
CALM (<1.1)	27.1	24.2	16.3	10.7	10.8	9.4	12.6	13.7	17.8	25.4	29.0	29.4	18.9	CALM (<0.5)
1.1- 3.1	1.1	1.1	0.6	0.2	0.5	0.5	1.2	1.6	1.7	0.7	1.3	1.3	1.0	0.5- 1.4
3.4- 5.4	22.1	23.7	20.3	19.7	18.9	21.6	25.3	24.8	24.6	27.6	26.2	23.6	23.3	1.5- 2.4 S
S 5.6- 7.6	12.8	14.1	17.8	18.4	20.9	22.4	23.0	21.7	20.5	17.5	15.0	14.9	18.3	2.5- 3.4 P
P 7.8- 9.8	10.2	10.6	13.7	15.2	16.7	16.6	14.8	14.7	12.6	10.8	10.1	9.5	12.9	3.5- 4.4 E
E 10.1-12.1	8.6	10.4	11.8	12.1	12.7	12.6	11.0	10.7	9.3	7.7	7.2	8.1	10.1	4.5- 5.4 E
E 12.3-14.3	6.0	5.6	7.4	8.9	9.1	8.2	6.3	6.5	6.0	4.9	4.6	5.1	6.5	5.5- 6.4 D
D 14.5-16.6	4.1	3.9	5.2	6.1	5.6	4.6	3.0	2.9	3.3	2.3	2.6	3.3	3.9	6.5- 7.4
16.8-18.8	2.6	2.8	2.9	3.9	2.3	2.7	1.9	1.6	2.2	1.8	2.0	1.9	2.4	7.5- 8.4 M
M 19.0-21.0	2.2	1.5	1.5	2.3	1.4	0.9	0.6	1.2	1.2	0.8	0.8	1.2	1.3	8.5- 9.4 E
I 21.3-23.3	1.2	0.7	1.2	1.3	0.7	0.3	0.1	0.4	0.4	0.3	0.5	0.9	0.7	9.5-10.4 T
L 23.5-25.5	0.8	0.5	0.4	0.7	0.2	0.1	0.1	0.1	0.2	0.1	0.4	0.3	0.3	10.5-11.4 E
E 25.7-27.7	0.5	0.3	0.5	0.4	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.2	0.2	11.5-12.4 R
S 28.0-30.0	0.4	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	12.5-13.4 S
/ 30.2-32.2	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	13.5-14.4 /
H 32.4-34.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.5-15.4 S
O 34.7-36.7	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	15.5-16.4 E
U 36.9-38.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.5-17.4 C
R 39.1-41.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.5-18.4 O
41.4-43.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.5-19.4 N
43.6-45.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.5-20.4 D
45.9-56.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.5-25.4
57.0-68.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.5-30.4
68.2-79.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.5-35.4
79.4-90.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.5-40.4
>90.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	>40.4
AVERAGE SPEED (MPH)	6.7	6.5	7.6	8.5	8.1	7.6	6.7	6.7	6.5	5.6	5.6	5.8	6.9	
AVERAGE SPEED (M/SEC)	3.0	2.9	3.4	3.8	3.6	3.4	3.0	3.0	2.9	2.5	2.5	2.6	3.1	
AVERAGE WIND POWER (WATTS/M**2)	78.0	61.0	71.0	77.0	57.0	49.0	39.0	40.0	44.0	34.0	41.0	51.0	53.0	

ANEMOMETER HEIGHT = 20.0 FEET = 6.1 METERS

SOURCE: BATTELLE PACIFIC NORTHWEST LABORATORIES